BYTE-BACK CO.

BB-1 MANUAL

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NEVER CONNECT OR DISCONNECT YOUR BB-1 TO YOUR COMPUTER WHEN POWER IS APPLIED.

BASIC OPERATION

The basic operation of the BB-1 is very simple. The LED's under each relay indicate the status of that relay. When the relay is closed the LED is on.

To close a relay and turn it's LED on you just poke the binary number corresponding to the relay you want closed into memory location 16382.

For example, POKE 16382, 1 will turn the 1st LED on the right on. POKE 16382, 2 will turn the 2nd LED on, (Counting from the Right). POKE 16382, 3 will turn the 1st and 2nd LED on. POKE 16382, 255 will turn all of the LEDs on. The sample program shown below will demonstrate more about how easy it is to control the LEDs and relays.

```
10 INPUT A
20 POKE 16382, A
30 GO TO 10
```

Run this program, then enter a number between 0 and 255 and the binary equivalent will be indicated by the LEDs. You can run the program again and enter a new number without reloading the program. Use the numbers 1,2,4,8,16,32,64, 128,to test each individual LED. Then you can play with other numbers between 0 and 255.

The program shown below will automatically cycle thru all of the numbers from 0 to 255.

```
10 FOR A=0 TO 255
20 POKE 16382, A
30 PAUSE 10
40 NEXT A
50 GO TO 10
```

This program will count from 0 (all LEDs off) to 255 (all LEDs on) and then repeat. The LEDs will indicate the count in binary format.

Change the number in the PAUSE statement to make the program go faster or slower. This is a good program to use to learn to count with binary numbers. The value goes from right to left in the following manner: 1,2,4,8,16,32,64, 128. For example if the three LED's on the right side were on, it would represent the number 7 (4+2+1=7).

This program will automatically turn each LED on and off.

```
10 LET N=0
20 LET A=2**N
30 LET N=N+1
40 POKE 16382, A
50 LET B=128-A
60 IF B=0 THEN GO TO 10
70 GO TO 20
```

The "POKE 16382, X" type of statement can be buried anywhere in your program. This latches the relays and LEDs in the state you select. You can continue to run your program and the outputs will not change until you POKE another number into memory location 16382.

To look at the eight inputs, you use the PEEK command. The statement, LET A=PEEK (16381) will store the status of the eight inputs in "A". A simple test of the input circuit is shown below:

```
10 LET A=PEEK 16381
20 PRINT A
```

This program will print "0" when there is nothing connected to the top connector. The inputs are normally held high by a 4.7K ohm pull-up resistor. You can change the state of an input by connecting it to ground. The inputs are the thin traces on the circuit side of the board. (Refer to the schemati drawing for actual pin numbers.) Ground is on pins 22A and 22B, but for a quick test you can put a clip lead from the metal heat sink that the regulator is mounted to (This is ground) to any of the inputs and then run the program above. The program will print the number corresponding to the input that you grounded.

Since all of the inputs are Schmitt Trigger type inputs, any variable resistance type device, such as a photocell or thermistor can be used. The Schmitt Trigger type input prevents oscillation by providing hysteresis between the off & on conditions. For example, when the resistance from an input to ground goes below approximately 1K ohms, it will be considered to be at ground. Then it will not be considered open until the resistance goes back above approximately 2.4K ohms.

The inputs are labeled 0 thru 7 to correspond to the data bits "D0 thru D7 in the computor. Refer to the schematic diagram for pin numbers.

Any time you do a "LET A= PEEK (16381)" statement, "A" will be a number between 0 and 255 corresponding to the binary number created by the inputs that are grounded. A simple subroutine can be used to decode this number to tell you which inputs are actually connected to ground.

The relays are rated at .75 amps max switch and 2 amps max carry. They are rated at 200 VDC, but DO NOT CONNECT 110 VAC TO THE BB-1 BD. BECAUSE OF THE DANGER OF ELECTRICAL SHOCK. The relays are rated for 10 million operation at max load and 100 million operations at signal loads.

A RADIO SHACK card edge connector #276-1551 or #276-1550 will mate with the top edge of the BB-1 for an input/output connector. The pin numbers printed on the connector will not match the BB-1, so refer to the BB-1 schematic when wiring the connector.

If you use your BB-1 to control any type of energy saving device, such as lights, heating or cooling, you may qualify for an Energy-Saving Tax Credit. The Energy-Saving Tax Credit is computed on Form 5695 which you attach to your tax return. Like other tax credits, it's more valuable than a deduction because it's subtracted from the final tax bill instead of from taxable income. Also, it can be claimed even of you use the standard deduction. The credit is equal to 15% of the combined cost of your computer and your BB-1.

BB-1 & 64K MEMORY

To use your BB-1 with a 64K memory module you must disable the 12K to 16K bank of memory or the 14K to 16K bank depending on the brand of memory you have.

TO USE MORE THAN ONE BB-1 AT A TIME

For output or POKE address		16382	
and input or PEEK address		16381	Standard factory unit
OPTION #1	POKE	16378	Cut the trace between "S" & "K".
	PEEK	16377	Jumper "B" to "D" & "C" to "K"
OPTION #2	POKE	16374	Cut the trace between "G" & "H".
	PEEK	16373	Jumper "A" to "E" & "F" to "H".
OPTION #3	POKE	16370	Make all of the above modifications
	PEEK	16369	

This new BB-1 offers several advantages over the old design. The new design uses considerably less current than the old unit. This eliminates the need for the extra wall transformer. Eliminating the extra wall transformer greatly improves the display. The new BB-1 still has its own +5V regulated power supply.

When you add extra BB-1's you may begin to overload your 9 volt wall transformer. This is especially true if you also are using a memory module. BYTE-BACK has a power booster kit ($9.95 plus $2 shipping) that will allow you to power the extra units. This kit has a jack and mounting bracket to mount on your BB-1 plus another 9 volt wall transformer.

The BB-1 requires the most current when all of the relays are closed. To tell if you are overloading your transformer, look for a dark horizontal line on your TV display. This line will be about one inch wide and will roll from the bottom of the screen to the top about every three seconds. It will also be darker when all relays are closed and all LEDs are on. The overload will not hurt the wall transformer or your computer, it just causes display problems.

SERVICE

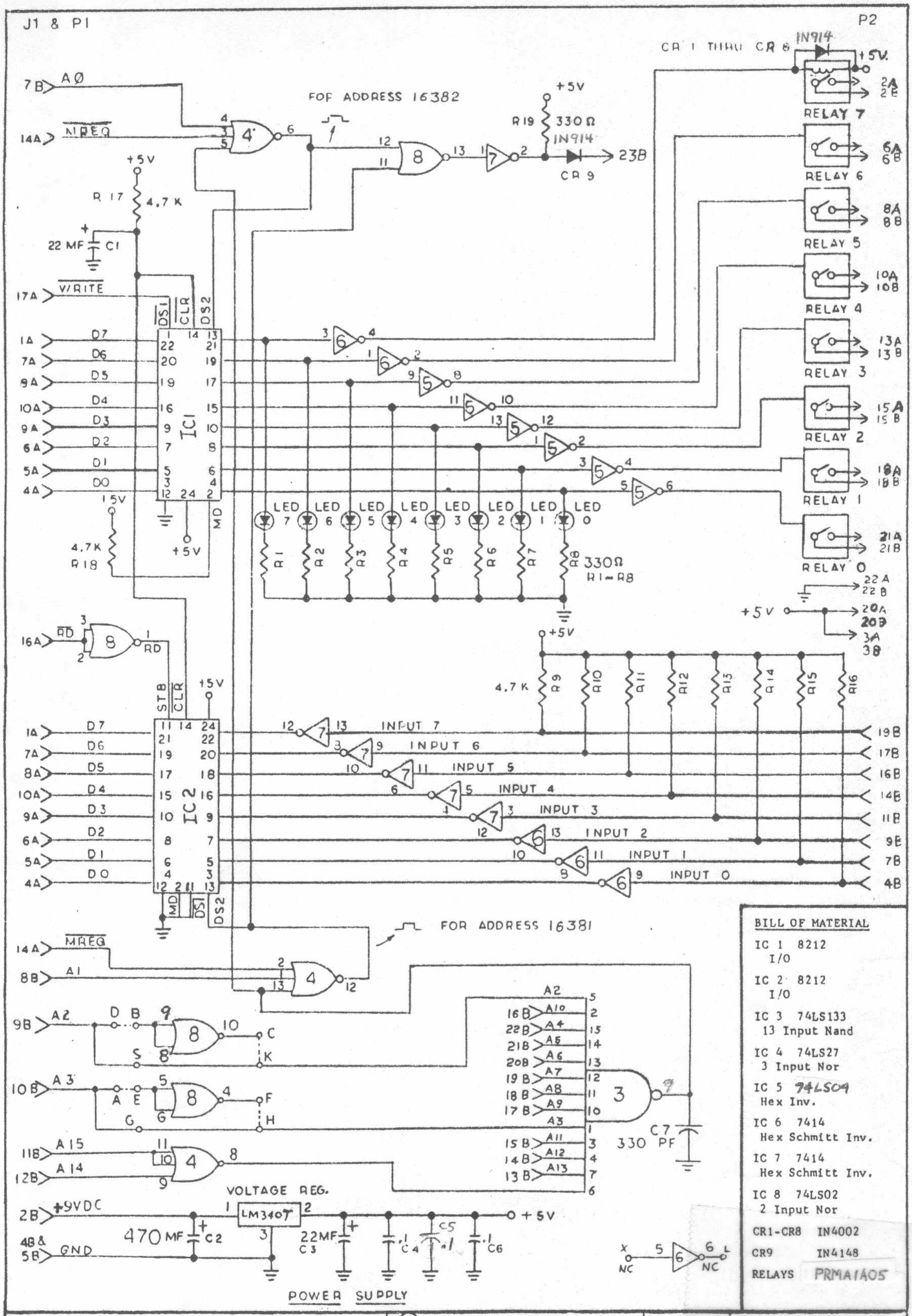
All BYTE-BACK modules carry a 90 day warranty. This includes kits. We will repair your BB-1 free during this period if you have any trouble with it. Naturally, in the case of kits, the warranty doesn't cover kits that have been assembled wrong. If your kit doesn't work, return it with $22 plus $3 shipping ($25 total) and we will repair it. On the other hand, if the problem is found to be defective parts supplied by us, we will refund the full service fee including the shipping charge, If your BB-1 is out of warranty, we will also repair it for $25. The warranty does not cover relays with burned contacts caused by an overload. Replacement relays are available for $5 each, which includes shipping.

Please return units to be repaired to this address:

BYTE-BACK INC.
[redacted]

cclear@pbtcomm.net

Please include a note with your name and address and your phone number plus a description of the problem.



BILL OF MATERIAL

IC 1 8212
I/O

IC 2 8212
I/O

IC 3 74LS133
13 Input Nand

IC 4 74LS27
3 Input Nor

IC 5 74LS04
Hex Inv.

IC 6 7414
Hex Schmitt Inv.

IC 7 7414
Hex Schmitt Inv.

IC 8 74LS02
2 Input Nor

CR1-CR8	IN4002
CR9	IN4148
RELAYS	PRMA1A05

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BB-1 SCHEMATIC

DATE: 3-8-83

BYTE-BACK BB-1 CONTROL MODULE

BILL OF MATERIALS

ITEM#	QNTY	DESCRIPTION
1.	2	8212, 8-bit input/output IC (24 pin) IC1, IC2
2.	1	74LS133, 13 input NAND IC, IC3
3.	1	74LS27, 3 input NOR IC, IC4
4.	1	74LS04, Hex Inv. IC, IC5
5.	2	7414, Hex Schmitt Inv. IC, IC6, IC7
6.	1	74LS02, 2 input NOR IC, IC8
7.	1	LM340T-5, 5 volt regulator
8.	9	1N914B, diode, CR1-CR9
9.	8	Red LED (light emitting diode)
10.	3	Capacitor, .1mf (Flat blue part) C4,C5,C6
11.	10	Resistor, 4.7k ohm ¼ w. 5% (yellow, violet, red, gold) R9-R18
12.	9	Resistor, 330 ohm ¼ w. 5% (orange, orange, brown, gold) R1-R8, R19
13.	1	Manual with instructions & schematic
14.	8	Relay, PRMA1A05
15.	1	Printed Circuit Board
16.	1	Small Finger Board
17.	1	330 pf Capacitor, C7(brown)
18.	1	Heat sink (flat aluminum)
19.	1	4-40x½" screw
20.	2	4-40 nut
21.	2	#4 lockwasher
22.	1	Capacitor, 470 mf. C2
23.	1	Connector (2x23 PCB edge connector to mate with expansion port)
24.	1	Key for PCB edge connector (included in connector)
25.	2	Capacitor, 22mf, C1, C3

NOTE: Items 7 thru 12 are in envelope #1.

Items 16 thru 25 are in envelope #2.

The integrated circuits are in two tubes (Items 1 thru 6)

NOTE: ALL MANUALS, PROGRAMS, PRINTED CIRCUIT BOARDS, & CIRCUIT DESIGNS ARE COPYRIGHTED MATERIAL.

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[redacted]

IMPORTANT: Read through the instructions before you start assembly.

If anything seems unclear or difficult, contact us for advice before going ahead.

1. PREPARATION

You will need a clean, dry and well lit workspace in which to assemble your kit. If possible, try to find somewhere where the parts can stay undisturbed in case you don't finish the kit all at once. You will need the following tools:

(a) A small electric soldering iron with a 15 to 25 watt heating element.
(b) Fine gauge solder with rosin flux. NOT acid flux.
(c) A pair of sharp diagonal cutters.
(d) A medium size ordinary screwdriver.
(e) A pair of needle nose pliers.

The following items are optional, but useful:

(a) A muffin pan from the kitchen makes an ideal organizer to allow you to sort and store all of the parts while you are building the kit.
(b) A magnifying glass for examining solder joints and looking for solder shorts.
(c) Some desoldering braid or other solder removing tool. Better still, take care that you put the components in right the first time. Removing them can be very difficult.
(d) A piece of foam is useful to stop components from falling out when you turn the board over to solder it.

2. PRECAUTIONS

There are several integrated circuits (I.C.s) in the kit. Most of them are susceptible to damage from static electricity. There's no cause for worry if a few precautions are taken:

(a) Keep the ICs in their protective packing until you are ready to use them.
(b) A soldering iron with a properly grounded tip is desirable.
(c) Carpets and clothing of man-made fibers, and synthetic soles on shoes, are prone to building up a static charge. Ground yourself by touching a large metal object if possible. It is better to work in a room without carpet.

3. COMPONENT IDENTIFICATION

Before you start assembly, check the components against the Bill of Materials and make sure you know what each part is. We have tried to cover all of the different markings of the components, but variations are possible.

All of the components have to go in one particular way, except the resistors and the three .1mf capacitors & 330 pf capacitor.

(a) The ICs have one end identified by a notch, and/or a spot or dimple next to pin 1. See Fig. 1. The bill of materials lists the integrated circuits

(ICs) by their generic number, such as 7414 or 74LS02. There will usually be a two-letter prefix before the generic number. This is different for different manufacturers. The parts will actually be labeled "DM7404N" or "SN74LS02N" etc. Note there is also a suffix "N" usually added to the generic number.

(b) The diodes (prefix CR on the schematic) have their cathodes identified by the band painted on the body. This corresponds to the flat bar of the schematic symbol. (See fig. 2) The assembly drawing & board show this bar on diodes.

(c) The electrolytic capacitors C1,C2, & C3 will have a + or - symbol printed on one end.

(d) The 8 red light emitting diodes (LEDs) are in envelope #1. These diodes like other diodes, must be inserted a certain way. The cathode is identified by a flat bar on the schematic just like other diodes. The cathode can be identified by two ways when looking at the actual part. The cathode lead is shorter and the ring around the base is flat on the cathode side.

(e) The 8 relays are blue and are easily identified. They are clearly marked. Be sure to follow the assembly instructions. They must be inserted a certain way. (See step 6)

4. CIRCUIT BOARD ASSEMBLY

After you have identified all of the parts and separated them you are ready to start the assembly. Two things are important. Follow the instruction carefully and do a good job soldering the parts in. Use a damp sponge or damp cloth and wipe your soldering iron tip occasionally to keep it clean. Be sure to use enough heat. Make sure both the component lead and the trace on the printed circuit board are hot enough to melt the solder. Assemble the kit as follows:

1. First position the printed circuit board (PCB) in front of you with the words "Copyright 1983" in the lower left corner. Now you have the component side facing up. THIS STEP IS VERY IMPORTANT. Refer to the assembly drawing (fig. 3) for the component locations. Assemble the components in the following order.

2 Use your needle nose pliers and form the leads of the 1N914B diodes. (CR1-CR8). Make sharp right angle bends so the diodes will lay flat against the PCB. Be sure the black band goes towards the bottom of the board as shown in figure 2.

3. Insert CR-9, the 1N914B diode on circuit side of board. There is a symbol on the board showing where this diode goes. Solder it from the circuit side of the board and cut the leads very close on the component side.

4. Turn the board over and insert all of the resistors on the component side. Refer to fig. 3. Don't solder any of the resistors until all of them are inserted and then checked again against the assembly drawing. Then turn the board over, solder the resistors and trim the leads. Be careful when triming leads. Face the board away from you to keep the leads from flying in a way that might hit you in the eye.

5. Insert the three blue .1mf capacitors as shown on the assembly drawing (fig. 3). Solder these components and trim the leads. These capacitors are C4, C5, & C6.

6. Next, put the relays on the board. Care must be taken not to put them in backwards. Assemble the relays on the board so that the printing reads from the top of the board to the bottom. (Note: The connector is at the bottom of the board) Pin 1 on the relay is indicated by a dot which is shown in figure 3. Be sure this is located correctly. After all relays are on the board, check them again and then solder them. Be sure to hold them firmly against the board while you are soldering them.

7. Now it's time to put the integrated circuits on the board. Take them out of their protective tubes and refer to section 2 of the instructions and read the precautions again. Also refer to section"a" under COMPONENT IDENTIFICATION and read this again.

   The ICs have one end identified by a notch, and/or a spot or dimple next to pin 1. (See fig. 1). Note that all of the ICs, except IC 8, face the same way on the board, i.e. with pin 1 towards the top left corner of the board when it is oriented so that you can read "Copyright 1983" in the bottom left corner. IC 8 is mounted horizontally and pin 1 is towards the bottom left corner.

   The ICs will have their pins spread out slightly and you will need to push them inward slightly by pressing against a flat surface before they will go in the holes. Make sure that each pin has gone into its respective hole and that none are curled up under the IC. Don't solder any of the ICs until after you have inserted all of them and checked them for correct orientation and checked them against the assembly drawing to make sure they are all in the proper location. Solder the ICs and then check around each solder joint to make sure that you didn't create any solder shorts. There are a lot of traces on the board that go close to the IC legs.

8. Next install the 8 red LEDs. Refer to par. "d" in the COMPONENT IDENTIFICATION section and refer to the assembly drawing to make sure you get the LEDs inserted correctly. Solder them and trim the leads. The flat side goe to the left.

9. Install the voltage regulator and the aluminum heat sink. Note that the heat sink assembly is shown in fig. 4. Be sure to tighten all of the nuts very securely and use the lockwashers where they are shown in fig. 4. Do not solder the voltage regulator until after all of the nuts are tight.

10. Refer to the assembly drawing and put C2 (470mf capacitor) on the board. Solder it and trim the leads.

11. The next component is the connector. Insert it on the component side. It doesn't go all the way against the board. It should be 1/4 " from the board. The best way to get it aligned and to get the proper distance is to put the connector on the board, but do not solder it and then plug the BB-1 Control board into your computer. Make sure the connector is fully seated. Then adjust the BB-1 board so that the ICs almost touch the back of the computer. Make sure the BB-1 board is standing up straight and not leaning forward or backwards. Solder all of the alignment points again. If everything looks ok, solder the other pins. Now inspect the solder joints very carefully. There are a lot of traces going between the connector pins. Check to make sure none of these are shorted to the pins. Disconnect the BB-1 from the computer.

12. Turn the board over to the circuit side again and insert the two 22mf capacitors as shown on the assembly drawing. (Fig. 3). These are capacitor C1 and C3. Be sure to orient the capacitors so that the + on the component goes to the hole with the + symbol near it as shown on the assembly drawing. Make sure the capacitors are flat against the board and then solder them in place. The leads on C3 will have to be trimmed before it is inserted in the board.

13. Install C7 on the component side of the board. It is located near IC4.

14. The small board that is used for the expansion port does not have to be put on until you need it. Test the board first. When you are ready to put this board on, bend the bottom row of connector pins up slightly and bend the top row down slightly. Insert the small board so that the cut-out is opposite the white key in the connector. Solder the pins to the fingers on the board. See Fig. 5.

15. Although it is not necessary, you can clean the flux off of your board with a spray can of "Rosin Flux Remover" available from Radio Shack.

16. Now your board is complete. Take pride in a job well done.

17. After you have completed the board and throughly checked all of the components against the assembly drawing and checked all of the solder joints, you are ready to test your BB-1. Refer to the Basic Operation section on the first page.

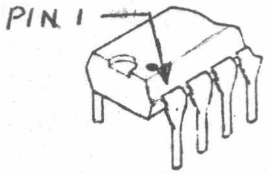


FIG. 1

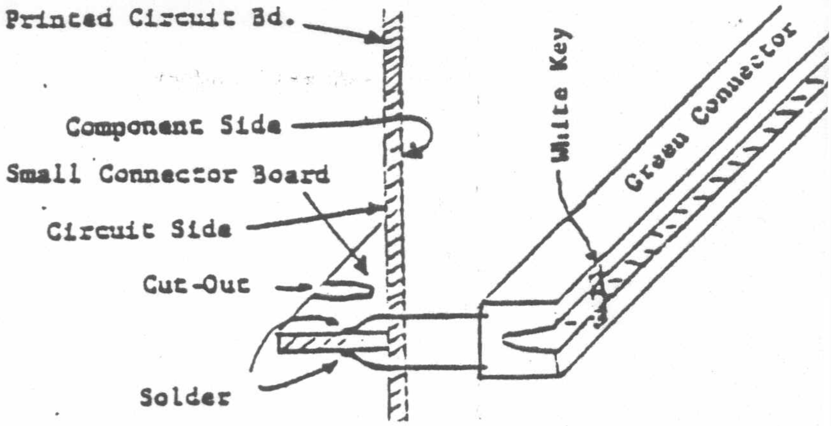
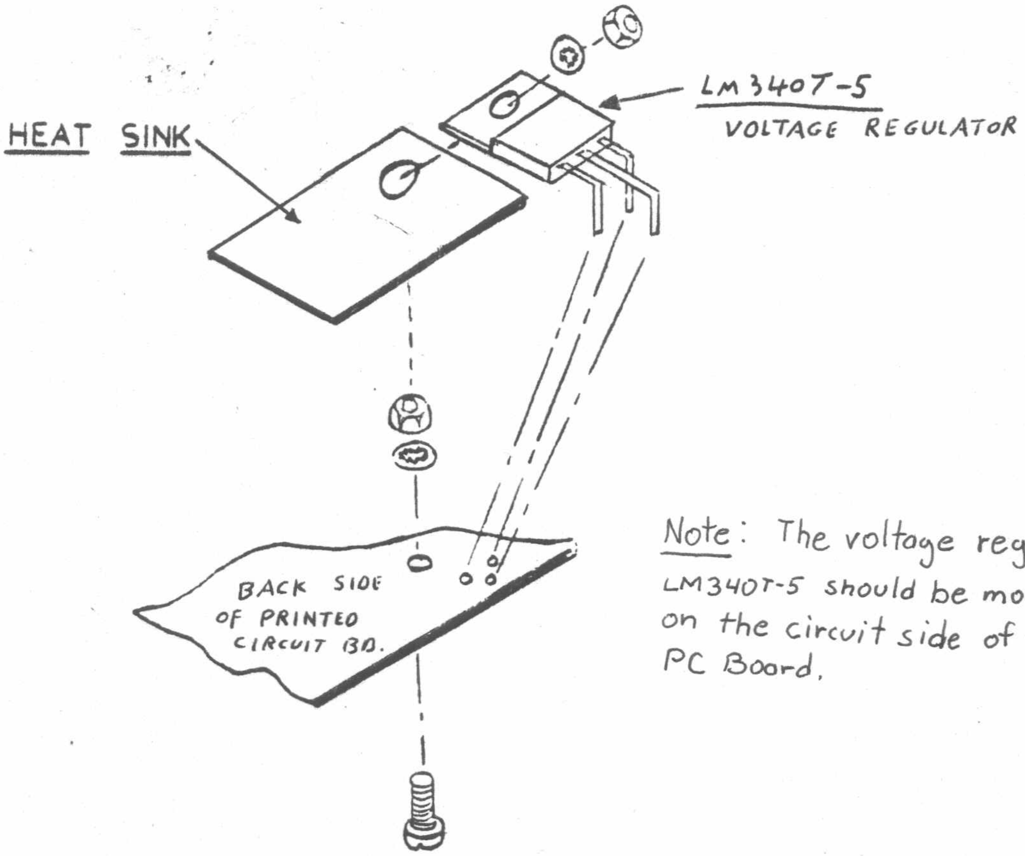


FIG. 5



Note: The voltage regulator LM340T-5 should be mounted on the circuit side of the PC Board.

FIG. 4

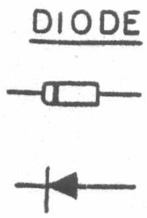


FIG. 2

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BB-1 → 2068 modification

* Circuit Side

1 Cut the trace leading to the 74LS133 pin 12 (A7).

2 Solder pins 12 and 13 on the 74LS133 together.

3 Cut the trace between pins 10 and 11 on the 74LS27.

4 Solder a jumper wire from the 46 pin green connector pin 19B (A7) to the 74LS27 pin 11.

5 Cut the trace leading to the 74LS27 pins 2 and 3 ($\overline{MREQ}$)

6 Solder a jumper wire from the 46 pin green connector pin 15A ($\overline{IORQ}$) to the 74LS27 pins 2 and 3

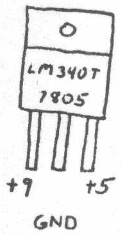
* Component Side

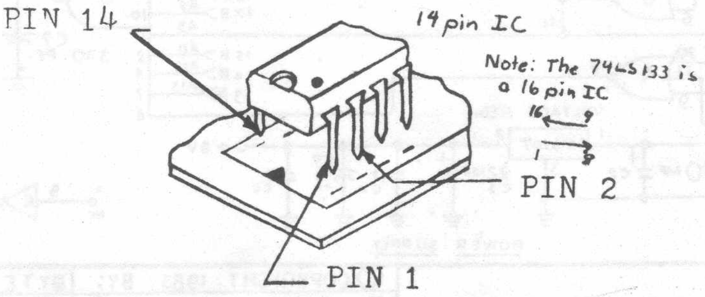
1 Cut the trace from the 46 pin green connector pin 2B (+9).

* Power supply options

Option A. To use the 2068's 5 volt output, cut the 5 volt pin on the LM 340-T-5 regulator and run a jumper from the 46 pin green connector pin 1B to the 5 volt pad on the pc board, where you just removed the 5 volt pin. You may completely remove regulator if you wish. This option should only be used when no other modules are using the 2068's +5.

Option B To use your own +9 power supply to power the BB-1, tie your +9 volt supply directly to the +9 and ground on the LM340T-5 voltage regulator. DO NOT clip any of the pins on the regulator.



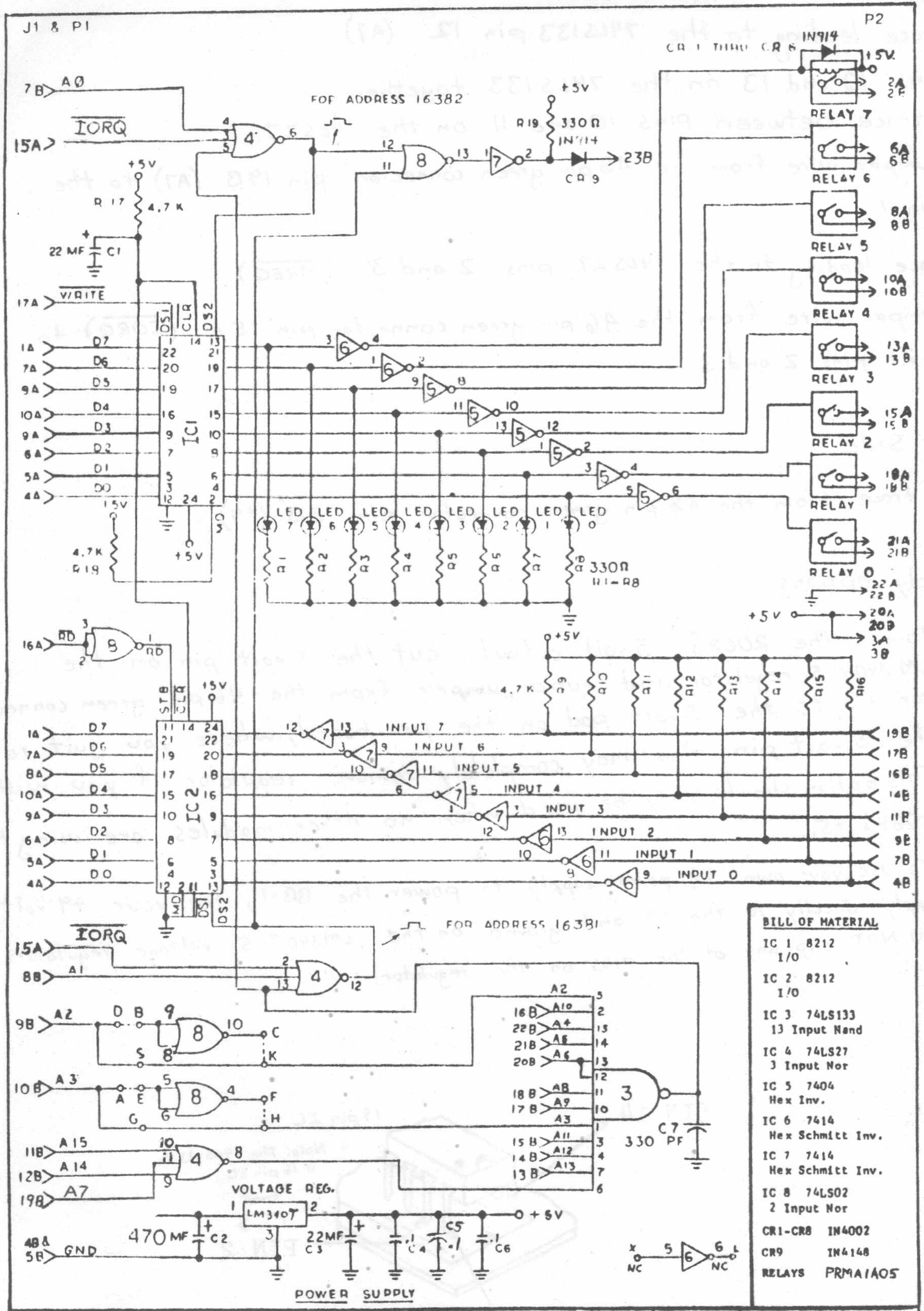


* Operation

Instead of POKE 16382, use OUT 16254,

Instead of PEEK 16381, use IN 16253,

2068 version



BILL OF MATERIAL

IC 1	8212 I/O
IC 2	8212 I/O
IC 3	74LS133 13 Input Nand
IC 4	74LS27 3 Input Nor
IC 5	7404 Hex Inv.
IC 6	7414 Hex Schmitt Inv.
IC 7	7414 Hex Schmitt Inv.
IC 8	74LS02 2 Input Nor
CR1-CR8	IN4002
CR9	IN4148
RELAYS	PRMA1A05

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For 2068

BB-1 SCHEMATIC

DATE: 3-8-83